clinical settings. Alpern and Dowell,[109] for example, reported on patients with nonhistotoxic clostridial bacteremia whose underlying diseases included various pulmonary disorders, congestive heart failure, bleeding peptic ulcer, cirrhosis and iron deficiency anemia. The bacteremia was seemingly benign in some cases since ten of 12 patients who did not receive antibiotics survived. Gorbach and Thadepalli[76] also made this observation in their patients at Cook County Hospital. They were able to evaluate 29 patients with blood cultures positive for clostridia including some histotoxic strains. Whereas twelve of the 29 patients had soft tissue infections involving clostridia, a number of patients had underlying diseases not usually associated with clostridial infection. These include six patients with aspiration pneumonia, two with cavitary tuberculosis, two with a seizure disorder and one with meningococcemia. Why clostridial bacteremia should develop in these patients is an interesting but unanswered question.

Management of clostridial soft tissue infection is as varied as the infectious syndromes these agents may cause. Appropriate drainage of focal infection and administration of penicillin are the cornerstones of therapy. With more serious infection, aggressive therapeutic intervention is indicated.

Therapy of Clostridial Myonecrosis

ARTHUR A. SCHWARTZ, MD*

SUCCESSFUL THERAPY of patients with clostridial myonecrosis depends in great measure on the general state of health of the patient and the rapidity with which the diagnosis is made. Delay in the initiation of therapy may yield catastrophic results.[62]

Appropriate surgical management of clostridial myonecrosis includes several therapeutic modalities. While the relative importance of each of the following aspects of treatment remains a topic of controversy, many authorities agree that combinations of (1) surgical debridement, (2) antibiotic therapy, (3) hyperbaric oxygen and (4) supportive measures are necessary. The administration of polyvalent antitoxin has not been shown to be effective, and many centers have discontinued use of the antitoxin because of the risk of hypersensitivity phenomena.[110]

Surgical debridement is included by virtually all authors as a cornerstone of therapy. The time of operation and extent of debridement is less clear. Altemeier suggests wide, emergent debridement with multiple incisions and appropriate fasciotomies.[62] Roding and co-workers recommended limiting emergent surgical therapy to opening the original wound and incising abscesses.[111] These authors suggest delaying definitive surgical procedures until demarcation of necrosis occurs, with the hope of limiting disfigurement.[111] Early surgical intervention not only may allow decompression but also, as noted above, facilitates early diagnosis.

The role of antibiosis is somewhat less clear. The drug of choice is aqueous pencillin in doses of 20 million units per day. While the efficacy of penicillin is difficult to delineate, animal models have suggested the beneficial effect of antibiotics.[112] Second line drugs, to be used in patients allergic to penicillin, include cephalosporins, chloramphenicol and erythromycin. Sensitivity testing is advisable, especially if tetracycline, another macrolide, clindamycin or carbenicillin is being used.[111]

Hyperbaric oxygen has been shown to decrease mortality, and has been suggested to limit tissue necrosis. Positive results using hyperbaric oxygen have been obtained from several laboratories.[111-114] In an experimental study, Demello and co-workers showed the value of 100 percent oxygen at three atmospheres, but also showed that for maximum effectiveness in their model, debridement and antibiotics should be used.[112]

Supportive measures should include careful medical management as well as anticipation and prompt therapy of complications of clostridial bacteremia.

Management of these patients frequently involves volume expansion with intravenous fluid, plasma and blood. Shock is a frequent complication and rapid volume expansion may be necessary. Monitoring central venous pressure or (more reliably) pulmonary capillary wedge pressure may be of value in severely ill patients. The role of steroids remains somewhat controversial. Additionally, careful monitoring of the electrolytes and packed cell volume may avert potential com-

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plications. Acute tubular necrosis is a not uncommon sequela of the shock and should be treated appropriately.

Hemolysis (especially in uterine myonecrosis) may be severe and require aggressive transfusion therapy.

Gas gangrene is a potentially preventable disease. Attention to good surgical principles is of primary importance with adequate debridement being the cornerstone of prevention. Antitoxin is ineffective as a prophylactic measure.

Summary

DAVID K. HENDERSON, MD: *The severity of all these syndromes depends in great measure on the potent toxins elaborated by these organisms. C botulism and C tetani produce neurotoxins while the histotoxic clostridia produce numerous toxins, most notaby phospholipase C, which are responsible for the extensive tissue destruction seen in the severe soft tissue infections.*

Specific antitoxins have been developed to counteract the effect of these toxins. These antitoxins, however, have met with limited success in the therapy of the clostridial-induced emergencies. Type B botulism antitoxin has been shown to be effective and hyperimmune antitetanus globulin is of value both in wound prophylaxis as well as in the therapy of tetanus. The efficacy of other antitoxins remains to be shown. Specific effective pharmacologic therapy for these syndromes, with the possible exception of guanidine in botulism, has yet to be developed.

Success in the management of each of these syndromes depends to a great extent upon rapid, accurate clinical diagnosis and the prompt initiation of both specific and nonspecific therapeutic measures. In the neuroparalytic syndromes, supportive care, particularly meticulous respiratory care, remains the cornerstone of therapy. Surgical debridement and drainage are of primary importance in the serious soft tissue infections.

Several areas of controversy remain to be clarified. The use of guanidine in botulism, the value of polyvalent antitoxin in myonecrosis and the use of antibiotics in all these syndromes are among those topics which need further study.

Each of these syndromes can be devastating and for that reason the clinician should maintain a high index of suspicion in the appropriate setting. Prompt diagnosis and therapy may prevent the development of a life-threatening toxic emergency.

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